SCHEME OF EXAMINATION

For

B. Tech. (Civil Engineering)

YEAR II, SEMESTER –III

(Effective from the session: 2010-2011)

Uttrakhand Technical University, Dehradun

w.e.f. 2010-11
## COURSES AND EVALUATION SCHEME
### B.TECH CIVIL ENGINEERING YEAR II,
#### SEMESTER –III
**(EFFECTIVE FROM SESSION :-2010-2011)**

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Course No.</th>
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| **Practical /Design** |            |                                | L       | T          | P          | CT     | TA     | Total | ESE |        |        |
|----------------------|------------|--------------------------------|---------|------------|------------|--------|--------|-------|     |        |        |
| 7.                   | PCE 351    | Fluid Mechanics Lab            | 0       | 0          | 2           | 25     | 25     | 25    | 50  | 1      |        |
| 8.                   | PCE 352    | Building Materials Lab         | 0       | 0          | 2           | 25     | 25     | 25    | 50  | 1      |        |
| 9.                   | PCE 353    | Surveying Lab                  | 0       | 0          | 3           | 25     | 25     | 25    | 50  | 2      |        |
| 10.                  | PCE 354    | Building Planning & Drawing    | 0       | 0          | 3           | 25     | 25     | 25    | 50  | 2      |        |
| 11.                  | GP-301     | General Proficiency (NSS/NCC/Sports/Cultural) | -   | -          | -           | -      | 50     | -     | 50  | -      |        |
| **Total**            |            |                                |         |            |             |        |        |       |     | 1000   | 28     |

**Common to Mechanical Engineering**

### Common to Mechanical, Biochemical & Chemical Engineering
TMA-301 MATHEMATICS –III

Unit – I : Function of Complex variable
Analytic function, C-R equations, Cauchy”s integral theorem, Cauchy”s integral formula for
derivatives of analytic function, Taylor”s and Laurent”s series, singularities, Residue

\[ \int_{0}^{2\pi} f \cos \theta \sin \theta \, d\theta \quad \text{and} \quad \int_{-\infty}^{\infty} f \, dx \]

Unit – II : Statistical Techniques - I
Moments, Moment generating functions, Skewness, Kurtosis, Curve fitting, Method of
least squares, Fitting of straight lines, Polynomials, Exponential curves etc., Correlation,
Linear, non –linear and multiple regression analysis, Probability theory. 08

Unit – III : Statistical Techniques - II
Binomial, Poisson and Normal distributions, Sampling theory (small and large), Tests of
significations: Chi-square test, t-test, Analysis of variance (one way) , Application to
engineering, medicine, agriculture etc.
Time series and forecasting (moving and semi-averages), Statistical quality control
methods, Control charts, X, R, p, np, and c charts. 08

Unit – IV : Numerical Techniques – I
Zeroes of transcendental and polynomial equation using Bisection method, Regula-falsi method
and Newton-Raphson method, Rate of convergence of above methods. Interpolation: Finite
differences, difference tables, Newton”s forward and backward interpolation , Lagrange”s and
Newton”s divided difference formula for unequal intervals. 08

Unit – V : Numerical Techniques –II
Solution of system of linear equations, Gauss- Seidal method, Crout method. Numerical
differentiation, Numerical integration , Trapezoidal , Simpson”s one third and three-eight
rules, Solution of ordinary differential (first order, second order and simultaneous)
equations by Euler”s, Picard”s and forth-order Runge- Kutta methods. 08

Reference Books :-
2. E. Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons,
4. T. Veerajan & T. Ramchandran, Theory & Problems in Numerical Methods, TMH,
   New Delhi, 2004.
1. Unit-I
**Time value of money**: Simple and compound interest, Time value equivalence, Compound interest factors, Cash flow diagrams, Calculation, Calculation of time –value equivalences. Present worth comparisons, Comparisons of assets with equal, unequal and infinite lives, comparison of deferred investments, Future worth comparison, payback period comparison. (8)

2. Unit-II
Use and situations for equivalent annual worth comparison, Comparison of assets of equal and unequal life. Rate of return, Internal rate of return, comparison of IIR with other methods, IRR misconceptions. (8)

3. Unit-III
**Analysis of public Projects**: Benefit/ Cost analysis, quantification of project, cost and benefits, benefit/ cost applications, Cost –effectiveness analysis. (9)

4. Unit-IV
Depreciation, computing depreciation charges, after tax economic comparison, Break-even analysis; linear and non-linear models. Product and Process Costing, Standard Costing, cost estimation, Relevant Cost for decision making, Cost control and Cost reduction techniques. (8)

**Reference Book**:
1. Horn gren, C.T., Cost Accounting, Prentice Hall of India
2. White, Engineering Economics, Wiley India
TCE-301  FLUID MECHANICS  L T P
3 1 0

Unit-I: Introduction: Fluid and continuum, Physical properties of fluids, Rheology of fluids.

Kinematics of Fluid flow: Types of fluid flows: Continuum & free molecular flows. Steady and unsteady, uniform and non-uniform, laminar and turbulent flows, rotational and irrotational flows, compressible and incompressible flows, subsonic, sonic and supersonic flows; subcritical, critical and supercritical flows, one, two and three dimensional flows, streamlines, continuity equation for 3D and 1D flows, circulation, stream function and velocity potential, source, sink, doublet and half-body.

Unit-II: Fluid Statics: Pressure-density-height relationship, manometers, pressure transducers, pressure on plane and curved surfaces, centre of pressure, buoyancy, stability of immersed and floating bodies, fluid masses subjected to linear acceleration and uniform rotation about an axis.

Dynamics of Fluid Flow: Euler’s Equation of motion along a streamline and its integration, Bernoulli’s equation and its applications- Pitot tube, orifice meter, venturi meter and bend meter, Hot-wire anemometer and LDA, notches and weirs, momentum equation and its application to pipe bends.

Unit-III: Dimensional Analysis and Hydraulic Similitude: Dimensional analysis, Buckingham’s Pi theorem, important dimensionless numbers and their significance, geometric, kinematics and dynamic similarity, model studies.

Unit-IV: Laminar and Turbulent Flow: Equation of motion for laminar flow through pipes, Stokes’ law, transition from laminar to turbulent flow, turbulent flow, types of turbulent flow, isotropic, homogenous turbulence, scale and intensity of turbulence, measurement of turbulence, eddy viscosity, mixing length concept and velocity distribution in turbulent flow over smooth and rough surfaces, resistance to flow, minor losses, pipe in series and parallel, power transmission through a pipe, siphon, water hammer, three reservoir problems and networks.

Unit-V: Boundary Layer Analysis: Boundary layer thickness, boundary layer over a flat plate, laminar boundary layer, application of momentum equation, turbulent boundary layer, laminar sub layer, separation and its control, Drag and lift, drag on a sphere, a two dimensional cylinder, and an aerofoil, Magnus effect.

Reference Books:

1. Fox, Introduction to Fluid Mechanics, Wiley India
2. S Narasimhan: First Course in Fluid Mechanics, University Press
4. M M Das: Fluid Mechanics & Turbomachines, Oxford University Press

w.e.f. 2010-11
TME- 303    SOLID MECHANICS

Unit-I
Introduction. Stress and strain: stress at point, Cauchy stress tensor, equilibrium equations, analysis of deformation and definition of strain components, compatibility relations, principal stresses and strains, stress and strain invariants, Mohr's circle representation.

Unit-II
Constitutive relations: true and engineering stress-strain curves, Material properties for isotropic materials and their relations. Theories of failures for isotropic materials.

Unit-III
Shear Force and Bending Moment diagrams. Axially loaded members. Torsion of circular shafts Stresses due to bending: pure bending theory, combined stresses.

Unit-IV
Deflections due to bending: moment-curvature relation, load-deflection differential equation, area moment method, and superposition theorem. Stresses and deflections due to transverse shears.

Unit-V
Torsion of circular shaft. Energy methods: Strain energy due to axial, torsion, bending and transverse shear. Castigliano's theorem, reciprocity theorem etc.

Reference Books:
1. Nag, Fundamentals of Strength of Materials, w/CD, Wiley India
3. Riley, Mechanics of Materials, Wiley India
TCE 302 Building Materials and Construction

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Pozzolona : Natural and Artificial fly ash, Surkhi (burnt clay pozzolona), rice husk and ash pozzolona, properties and specifications for use in construction.


Asphalt, Bitumen and Tar : Terminology, specifications and uses, Bituminous materials.

**Unit – II**: Chemistry of Plastics manufacturing process, classification, advantages of plastics, Mechanical properties and their use in construction.


Insulating Materials: Thermal and sound insulating material desirable properties and type.


**Reference Books:**
1. S K Duggal : Building Materials , New Age International
2. P.C. Varghese : Building Materials , PHI
TCE 303

Basic Surveying

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Unit – I: Importance of surveying to engineers, plane and geodetic surveying, principles of surveying, classification of surveys

Principles of different methods and their accuracies, measurement by tape, Reference meridians, bearing and azimuths, magnetic declination, compass, Vernier theodolite, temporary adjustments, measurements of horizontal angle, modern trends- EDM, electronic theodolites and Electronic Total Station. (4)

Unit – II: Methods of determining elevations, Direct levelling- basic terms and definitions, principle, booking and reduction of field notes, curvature and refraction, automatic levels, Contouring- methods and uses

Definition, Principles of stadia systems, subtense bar and tangential methods (2)

Unit – III:

Elements of simple circular curves, theory and methods of setting out simple circular curves, transition curves- types and their characteristics, ideal transition curve, equations of various transition curves, Introduction to vertical curves (5)

Unit – IV

Principles of traversing by compass and theodolite, computations of traverse coordinates, Principles and classification of triangulation systems, strength of figures, satellite stations, intervisibility of stations, triangulation field work (5)

Principles, plane table equipments, methods, resection by three point problem (2)

Reference Books:

1. S K Duggal : Surveying Vol 1 & 2 , TMH
2. Surveying, 5th Edition, Mc Cormac, Wiley India
3. R Subramanian : Surveying & Leveling , Oxford University Press
4. B C Punamia : Surveying & Leveling
5. C Venkatramaih : Text Book of Surveying , University Press

w.e.f. 2010-11
PCE-351 Fluid Mechanics Lab

1. To verify the momentum equation using the experimental set-up on diffusion of submerged air jet.
2. To determine the coefficient of discharge of an orifice of a given shape. Also to determine the coefficient of velocity and the coefficient of contraction of the orifice mouth piece.
3. To calibrate an orifice meter, venturimeter, and bend meter and study the variation of the co-efficient of discharge with the Reynolds number.
4. To study the transition from laminar to turbulent flow and to determine the lower critical Reynolds number.
5. To study the velocity distribution in a pipe and also to compute the discharge by integrating the velocity profile.
6. To study the variation of friction factor, „f‟ for turbulent flow in commercial pipes.
7. To study the boundary layer velocity profile over a flat plate and to determine the boundary layer thickness.

PCE-352 BUILDING MATERIALS LAB

I. Cement (Two turns only)
1. Normal Consistency of cement.
2. Initial & final setting time of cement
3. Compressive strength of cement
4. Fineness of cement by air permeability and Le-chatalier‟s apparatus.
5. Soundness of cement.
6. Tensile strength
II. Coarse Aggregate (Two turns only)
1. Crushing value of aggregate
2. Impact value of aggregate
3. Water absorption of aggregate
4. Sieve Analysis of Aggregate
5. Specific gravity & bulk density
III Fine Aggregate: (one turn only)
1. Sieve analysis of sand
2. Silt content of sand
3. Bulking of sand
IV) Destructive and non destructive testing on concrete
V) Physical and mechanical properties of reinforcing steel.
2. Dimension Tolerances
3. Compressive strength
4. Efflorescence

w.e.f. 2010-11
PCE 353  
**SURVEYING LAB**

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1. Study of different types of topographical maps and to prepare conventional symbols chart.
2. To measure bearings of a closed traverse by prismatic compass and to adjust the traverse by graphical method.
3. To find out reduced levels of given points using dumpy/Auto level.
4. To perform fly leveling with a Auto /tilting level.
5. To study parts of a vernier / Electronic theodolite and practice for taking angle measurements.
6. To measure vertical angle of given points by Electronic theodolite.
7. To measure horizontal angle between two objects by repetition method with three repetitions.
8. To measure horizontal angle by method of reiteration
9. To determine the elevation of chimney top by trigonometrical levelling by taking observations in single vertical plane.
10. To set out a simple circular curve by Rankine”’s method
11. To study various parts and practice with Wild T-2 micro-optic theodolite and EDM (Distomat DI-1600).

PCE-354  
**BUILDING PLANNING & DRAWING LAB**

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Drafting of following Using Any CAD software

1. Symbols used in Civil Engineering drawing, Masonry Bonds
2. Doors, Windows and staircases.
3. Plumbing & Electrical fitting drawing.
4. Comprehensive Drawing of Residential building (Layout, plan, elevation & sectional elevation, plumbing & electrical fillings in out)
5. Preparation of Layout planning of different civil engineering Projects.
6. Preparation of lay out plan/Maps and building drawing using computer

w.e.f. 2010-11
SCHEME OF EXAMINATION

For

B. Tech. Civil Engineering

YEAR II, SEMESTER –IV

(Effective from the session: 2010-2011)

Uttrakhand Technical University, Dehradun
COURSES AND EVALUATION SCHEME
B. Tech. Civil Engineering
YEAR II, SEMESTER –IV
(Effective from Session 2010-11)

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w.e.f. 2010-11
TCE 401 HYDRAULICS AND HYDRAULIC MACHINES

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Unit I
Introduction: Difference between open channel flow and pipe flow, geometrical parameters of a channel, Velocity and pressure distribution in an open channel, Continuity equation. (3)

Uniform Flow: Chezy’s and Manning’s equations for uniform flow in open channel, Equivalent roughness, most efficient channel section, simple problems of compound channel sections. (5)

Unit II
Energy and Momentum Principles: Critical depth, concepts of specific energy and specific force, application of specific energy principle for interpretation of open channel phenomena, flow through vertical and horizontal contractions. (8)

Unit III
Non-Uniform flow in Open Channel: Equation of gradually varied flow and its limitations, flow classification and surface profiles, integration of varied flow equation by analytical, graphical and numerical methods, flow in curved channels. (6)
Mobile Bed Channel Hydraulics: Difference between rigid and alluvial channels, Incipient motion condition, Different approaches to study sediment motion, Tractive force approach, Shields curve, Types of bed forms or regimes of flow, characteristics and types of sediment load. (3)

Unit IV
Hydraulic Jump, Surges, Water Waves: Classical hydraulic jump, Evaluation of the jump elements in rectangular and non-rectangular channels on horizontal and sloping beds, Use of jump as an energy dissipater, End depth in a free overfall, Equation of motion for unsteady flow, open channel surge, celerity of the gravity wave, deep and shallow water waves. (5)
Hydraulic Pumps: Rotodynamic pumps, basic equations, axial and mixed flow pumps, cavitation in pumps, characteristics curves. (3)

Unit V
Hydraulic Turbines: Introduction, Rotodynamic Machines, Including elementary concept of bulb and tubular turbines pelton Turbine, equations for jet and roter size, efficiency, spear valve, reaction turbines, Francis and Kaplan type, Head on reaction turbine, basic equation for type, Head on reaction turbine, basic equation for rotodynamic machines, similarity law and specific speed, cavitation characteristic curves. (8)

Reference Books:
1. Fox, Introduction to Fluid Mechanics, Wiley India
TCE 402  STRUCTURAL ANALYSIS – I

Unit I  (3)
Classification of Structures, stress resultants, degrees of freedom, Static indeterminacy
Classification of Pin jointed determinate trusses, Analysis of determinate plane and space trusses (compound and complex)

Unit II  (5)
Rolling loads, influence lines for beams and trusses, Absolute maximum bending moment, Muller-Breslau’s principles & its application.

Unit III  (8)
Analysis of Arches, Linear arch, Eddy’s theorem, three hinged parabolic arch, two hinged arch, spandrel braced arch, moving load & influence lines.

Unit IV  (8)
Equilibrium of light cable, General cable theorem, uniformly loaded cable, anchor cables, temperature stresses in suspension cables, three hinged stiffening girder, two hinged stiffening girder, temperature stresses in two hinged girder.

Unit V  (8)
Strain Energy of deformable systems, Maxwell’s reciprocal & Betti’s theorem, Castigliano’s first theorem, unit load & Conjugate beam methods.

Reference Books:
1. West, Fundamentals of Structural Analysis, Wiley India
TCE 403  ADVANCED SURVEYING  

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Unit I  
Triangulation and Trilateration  
Necessity of Control Surveying, Principle of Triangulation and Trilateration classification of Triangulation Systems Station Marks, Towers and Signals, Satellite station, Intersected and Resected points, Reconnaissance, Intervisibility of stations, Angular Measurement, Base line measurement and its extension

Unit II  
Adjustment Computations  
Treatment of random errors, Normal law of errors, Most Probable Value, Weight of observations, Propagation of errors and variances, Principle of Least Squares, Observations and correlative Normal Equations, Adjustment of triangulation figures and level nets.

Unit III  
Curves  
Classification of curves, Elements of Simple Circular, Transition and Vertical curves, Theory and methods of setting out circular, transition and vertical curves, special field problems.

Unit IV  
Project Surveys  
General requirements and specifications for Engineering project surveys, Reconnaissance, Preliminary and Location surveys for highways, railways and canals, Correlation of surface and underground surveys in case of culverts, Bridges and Tunnels; Principles and practice of hydrographic surveys, Layout of culverts, canals, bridges and buildings.

Field Astronomy  
Astronomical terms, co-ordinate systems, Spherical trigonometry, Astronomical triangle, Relationship between coordinates.

Unit V  
Photogrammetry and Remote Sensing  
Photogrammetry-Introduction, Scale of photograph, Tilt and height displacement, Stereoscopic vision and stereoscopes, Techniques of photo-interpretation, Principles of remote sensing, Electro Magnetic Radiation (EMR), energy interaction with atmosphere and earth features, spectral signatures, Remote sensing satellites and their data products, methods of interpretation of remotely sensed data.

GPS and GIS  
Global Positioning System (GPS)-Introduction, principle, and applications of GPS in different fields of Surveying, Geographic Information System (GIS) – Introduction, Geographical concepts and terminology, Applications of GIS

Reference Books:  
TCE 404  ENGINEERING GEOLOGY

Unit I

Unit II

Unit III
Earthquake causes, classification, earthquake waves, intensity and magnitude, Seismic zones for India, Geological consideration for construction of building.

Underground water, sources, Aquifer, Artesian well, Ground water provinces of India and its role as geological hazard.

Unit IV
Geological investigations for site selection of dams & reservoirs, tunnels, bridges and highways. Reservoir induced seismicity.
Methods of Geophysical explorations-gravity, electrical and seismic, methods.

Note: In tutorial class of this subject’s, students shall practice for mineral & rock identifications

Reference Books:
UNIT-1  
**Water supply:** Water demands and domestic use, variation in demands; population forecasting by various methods using logistic curve method; per capita supply, basic needs and factors affecting consumption; design period.  
Sources of water: Kinds of water sources and their characteristics, collection of surface and ground water; quality of surface and ground waters; factors governing the selection of a source of water supply; intakes and their design for lakes, streams and rivers, impounding reservoir and canal; determination of the capacity of impounding reservoir. (7)  

UNIT-2  
Transmission of water: Various types of conduits, capacity and sizes including economical sizes of rising main, structural requirements; laying and testing of water supply pipelines; pipe materials, joints, appurtenances and valves; leakages and control; water hammer and its control measures. (4)  

UNIT-3  
Storage and distribution of water: Methods of distribution, pressure and gravity distribution systems, concept of service and balancing reservoirs, capacity of distribution reservoirs; general design guidelines for distribution system, Hardy - Cross method, Newton - Raphson method and equivalent pipe method of pipe network analysis; rural water supply distribution system.  
Water supply, plumbing systems in buildings and houses: water connections, different cocks and pipe fittings, hot water installation. Institutional and industrial water supply. (6)  

UNIT-4  
**Wastewater collection:** Systems of sanitation and wastewater collection, estimation of wastewater flows and variations in wastewater flows.  
**Storm water:** Collection and estimation of storm water by different formulae. (6)  
Flow in sewers: Flow in full and partially full sewers and design of sewers; types of sewers, materials and construction of sewers, joints and sewer appurtenances, layout and construction of sewer lines; small bore sewer systems. Planning of sewerage systems. Institutional and industrial wastewater management. (6)  

Reference books:  
1. Nazaroff, Environmental Engineering Science, Wiley India  
3. Development, Government of India, New Delhi  
5. Development, Government of India, New Delhi  
6. Steel and McGhee: Water Supply and Sewerage  
7. Fair and Geyer: Water Supply and Wastewater Disposal
8. Hammer and Hammer Jr.: Water and Wastewater Technology
9. Raju: Water Supply and Wastewater Engineering
10. Sincero and Sincero: Environmental Engineering: A Design Approach
11. Pandey and Carney: Environmental Engineering
12. Rao: Textbook of Environmental Engineering
13. Davis and Cornwell: Introduction to Environmental Engineering
17. Ramalho: Introduction to Wastewater Treatment Processes
18. Parker: Wastewater Systems Engineering
Unit-I: Concrete as a Building Material and its gradients:

(ii) Testing of Cement for general physical and chemical properties as per BIS specifications.

(iii) Different types of cement such as Slag Cement, Portland Pozzolona Cement and high Alumina cement, their characteristics, composition, use and properties. (8)

Unit-II: Aggregates and Testing of Aggregates:
Classification, source, physical and mechanical properties. Testing of Aggregates for physical and mechanical properties. (7)

Unit-III: Production of Fresh Concrete:

(ii) Properties of Hardened Concrete.
Strength and durability, Factors affecting strength and durability of concrete.Mechanics of setting and hardening of concrete (4)

Unit-IV: Concrete Mix Design: principle and Methods, Statistical Quality control. Concrete Rheology, Maturity concept. (4)

Introduction to special concretes:
(a) Admixtures in concrete.
(b) Special concrete as lightweight concrete. High Density Concrete, Sulpher Impregmneted concrete Polymer concrete, Lime concrete constituents and uses.
(c) High strength concrete (d) Fibre Reinforced Concrete (e) High performace concrete, Ready mix concrete and mass concrete (5)

Unit-V: Material testing and instrumentation:

References

2. Hassoun, Structural Concrete- theory & Design , Wiley India
1. To determine the Manning’s coefficient of roughness “$n$” for the given channel bed.
2. To study the velocity distribution in an open channel and to find the energy and momentum correction factors.
3. To study the flow characteristics over a hump placed in an open channel.
4. To study the flow through a horizontal contraction in a rectangular channel.
5. To calibrate a broad-crested weir and study the pressure distribution on the upstream face of the weir.
6. To study the characteristics of free hydraulic jump.
7. To study the flow over an abrupt drop and to determine the end (brink) depth for a free over fall in an open channel.
8. To study rotodynamic pumps and their characteristics.
9. To study rotodynamic turbines and their characteristics.
PCE 452  ADVANCED SURVEY FIELD WORK

1. Study and use of different types of micro-optic theodolites and total stations.
2. To carry out Triangulation and Trilateration of a given area.
3. To adjust the angular observations taken in triangulation exercise and compute the adjusted coordinates of triangulation stations.
4. To plot the coordinates at a given scale on Plane Table and their field checking.
5. To Layout a simple circular curve on the ground using linear methods.
6. To Layout a simple circular curve on the ground using Angular methods
7. To Layout a building and a culvert on the ground.
8. Study of satellite imagery and visual image interpretation.
9. GPS demonstration and coordinate observations.
10. GIS demonstration and study of its applications.

PCE 453  GEOLOGY LAB

1. Megascopic study of minerals
2. Specific Gravity
3. Megascopic study: Igneous, Sedimentary, Metamorphic
4. Stuck and Dip
5. Geological sections of maps
   Site selection, dam, tunnels, highways, hill roads etc.

PCE 454  CONCRETE LAB

1. Fineness modulus and grain size distribution
2. Abrasion test on aggregate
3. Slump Test
4. Workability of concrete
5. Concrete mixed design as per Indian Standard recommendation guidelines.
6. Effect of water cement ratio on the strength of concrete